

“ASSESSMENT OF BIOMEDICAL WASTE MANAGEMENT KNOWLEDGE, ATTITUDES, AND PRACTICES AMONG HEALTHCARE PROVIDERS IN UNAUTHORIZED CLINICS IN LAHORE, PAKISTAN”

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Abstract

Background:

Biomedical waste has been defined as “any waste that is produced during the diagnosis, treatment, immunization of human beings or animals, or in the research activities related to or in the production or testing of biological products and includes categories or classes mentioned in the schedule. The rules for biomedical waste management and its handling were notified in 1998 and amended twice in 2000. Biomedical waste has been categorized into four classes based on the type of waste and treatment choices: yellow for excreta, tissues, or body fluids; red for tubing and syringes (without needles); white for sharps; and blue for glass material. Waste must not be stored beyond a period of 48 hours.

Methodology:

The design of the study was descriptive. A convenient sampling technique was used with a closed-ended questionnaire. The data was collected using a questionnaire adapted from the previous studies. The sample size was 160 participants. Finally, 160 valid questionnaires were used for data analysis.

Results:

The study findings have revealed that all results were significant, the scale was reliable, and there was a strong need to improve knowledge, attitude, and practice about biomedical waste management in an illegal clinic in Lahore, Pakistan.

Conclusion:

In this study, a very large number of participants were not aware of the rules of biomedical waste management that were made and amended, but a maximum percentage of participants thought that it was important to know about biomedical waste management, whereas many of them did not know about the basic rules regarding biomedical waste handling and disposal. This study should conduct awareness programs and set protocols regarding biomedical waste

management to create a safe environment in illegal clinics and in our society.

CHAPTER 1 INTRODUCTION

Background of the study:

Nowadays, biomedical waste (BMW) management has become a hazard issue. In healthcare, various types of waste can be produced, including sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices, and radioactive materials (Assemu, D.M. et al., 2020). Hospital waste is classified as hazardous and non-hazardous waste, of which 10–25% is hazardous waste categorized by the World Health Organization (Debere, M.K., et al., 2013). Dental waste is a subdivision of hazardous biomedical waste. It includes various materials like soaked cotton, sharp needles, extracted teeth, human tissue parts, etc. Which are usually contaminated with body fluids like blood and saliva (Sharma *et al.*, 2018). The scope of the rules has been expanded to incorporate numerous health camps like vaccination camps, blood donation camps, and surgical camps. The segregation, packaging, transportation, and storage of biomedical waste have improved. Biomedical waste has been categorized into four classes based on the color code, type of waste, and treatment choices. In addition, untreated human anatomical waste, animal anatomical waste, soiled waste, and biotechnology waste mustn't be stored beyond a period of 48 hours. In the event that there is a need to store beyond 48 hours, the occupier ought to take all appropriate measures to confirm that waste doesn't adversely affect human health and therefore the surroundings (Government of India, Ministry of Environment, Forestry, and Climate Change, 2016). There are various colors that indicate different types of biomedical waste. These colors also indicate the level of caution that needs to be taken when handling such materials. A yellow-colored waste bin indicates many types of waste. In yellow bins, there can be excreta, tissues,

organs, or bodily fluids. They could also involve chemicals, dirty bed sheets, animal remains, or laboratory waste. Yellow bins are going to be used by the most general medical practitioners. In red containers, there should be contaminated waste product that has been in contact with hazardous substances. For example, IV tubes, catheters, tubing, or syringes (without the needle) can all be collected in red bins. Most of these materials can be recycled because they're plastic. These white containers are used for sharps and should be lined with puncture-proof baggage. Sharps will embody used needles, scalpels, or blades. It should be sent to a sanitary landfill. Blue cardboard boxes can be used to discard numerous glass materials. Beakers, medication vials, and other broken glass equipment can be placed in these receptacles. To ensure proper collection, all of those containers should be clearly labeled and placed in the same area. This way, no waste will be left behind, and the whole environment can be safe from biomedical hazards. (BWS Inc., Regulated Waste Solution, 2018). The duties of the occupier of a healthcare facility have been revised. The occupier is the person who has administrative control over the healthcare facilities that generate biomedical waste. For this mandatory pretreatment of the laboratory, microbiological waste, and bloodbags on-site before disposal, either at the Common Bio-Medical Waste Treatment Facility or on-site. The method of sterilization or disinfection ought to be in accordance with the National AIDS Control Organization (NACO) or WHO (World Health Organization). The use of chlorinated plastic bags, gloves, blood bags, etc. should be gradually stopped, and this phase-out should be within two years from the date of notification of these rules. To provide training to all its health care workers and shield them against diseases like hepatitis B and tetanus through immunization.

Liquid waste should be separated at the source by pretreatment before mixing with other liquid waste. To set up a barcode system for biomedical waste that's to be sent out of the place for handling and disposal. All paramount accidents, including those caused by fire hazards, blasts, the handling of biomedical waste, and alternative actions taken by the prescribed authority, should be reported. The present incinerator should be upgraded or modified to attain the new standard within two years from the date of this notification. The register of biomedical waste disposal should be maintained daily and updated monthly on the website. (Walkinshaw, 2011). Almost one gram of mercury, the amount in a fever thermometer, can be deposited in a 20-acre lake from the atmosphere. This small amount, over time, will contaminate the fish in that lake. (The Interstate Mercury Education and Reduction Clearing House, 2004). Proper storage and security measures are necessary, and there are plenty of steps you can take to ensure that the data doesn't fall into the wrong hands (Shakeel et al., 2025). Therefore, make it clear that confidential material like patient data can't be disposed of in a recycle bin. (Anonymous, 2012). The rules are appropriate for each hospital and nursing home, veterinary institution, animal house, or slaughter house that produces biomedical waste. In this regard, healthcare workers have a crucial responsibility to properly segregate and train the staff at their disposal. Lack of awareness regarding the health hazards related to healthcare waste, inadequate training in proper waste management, absence of waste management and disposal systems, insufficient financial and human resources, and therefore the low priority given to the topic are the most common issues connected with healthcare waste. (Sharma et al., 2017)

Significance:

Biomedical waste management is a critical component of infection prevention and environmental safety within healthcare systems.

In developing countries such as Pakistan, inadequate handling and disposal of biomedical waste pose serious risks to health care workers, patients, the community, and the environment.

These risks are further amplified in unauthorized clinics, where regulatory oversight, formal training, and standardized waste management practices may be limited or absent.

This study is significant as it aims to assess the knowledge, attitudes, and practices (KAP) of healthcare providers working in unauthorized clinics in Lahore, Pakistan, regarding biomedical waste management. By identifying gaps in knowledge, misconceptions, and unsafe practices, the study will provide valuable insights into the current status of waste management in informal healthcare settings, which are often underrepresented in research.

The findings of this study was beneficial for healthcare professionals, particularly nurses, paramedics, and clinic assistants, by highlighting the need for targeted training programs and capacity-building initiatives. It will also assist public health authorities and policymakers in designing and implementing effective interventions, guidelines, and monitoring mechanisms to improve biomedical waste management practices in such settings.

Furthermore, this research was contributed to the protection of public health by promoting safer waste handling practices, thereby reducing the risk of infections, needle-stick injuries, and environmental contamination. It was also support efforts to align local practices with national and international standards for biomedical waste management.

From an academic perspective, the study was added to the existing literature on biomedical waste management, particularly in the context of unauthorized clinics, and serve as a foundation for future research and policy development. Overall, the study seeks to bridge the gap between knowledge and practice, ultimately contributing to improved healthcare safety and environmental sustainability.

Justification of the study:

This study identifies awareness, knowledge, attitude, and behavior about biomedical waste management.

In Pakistan, the cases of HIV are increasing because of improper handling and a lack of awareness of biomedical waste management. The history of needle stick injuries was present in 85.1% of participants, of which the most common were from syringe needles (47.52%), surgical stitch needles (20.9%), and surgical blades (9.5%). Most of the needle stick injuries took place while recapping needles (33%), performing surgical procedures (27.7%), drawing blood samples (26.2%), and improperly handling such waste. (Khurram *et al.*, 2011). In Pakistan, awareness of biomedical waste management is not sufficient. So, this study assesses the knowledge, attitude, and behavior towards biomedical waste management in Pakistan. To increase awareness about biomedical waste management among healthcare personnel, they must gain sufficient knowledge and education. The biomedical waste imposes notable hazardous dangers on patients, healthcare workers, the community, and its surroundings. Thus, the knowledge concerning biomedical waste management among health care personnel changes their attitude and health practices, hence having a great impact on health and surroundings. (Kumar *et al.*, 2015).

Problem statement:

The problem statement of this study biomedical waste management is a fundamental component of infection prevention and environmental safety in healthcare settings. Improper handling, segregation, transportation, and disposal of biomedical waste can result in serious health risks, including the transmission of infectious diseases such as hepatitis B, hepatitis C, and human immunodeficiency virus (HIV), as well as environmental contamination. Globally, it is estimated that nearly **15–25% of healthcare waste is hazardous**, posing a significant risk to human health and the environment if not

managed properly. In developing countries, including Pakistan, inadequate biomedical waste management practices remain a persistent public health challenge.

In Pakistan, studies have reported that a considerable proportion of healthcare facilities do not adhere to standard biomedical waste management guidelines, with **only 40–60% compliance** observed in proper waste segregation and disposal practices. The situation is likely to be more concerning in unauthorized (unregistered) clinics, which operate outside formal regulatory frameworks and often lack trained personnel, standard protocols, and monitoring systems. In urban areas such as Lahore, where a large segment of the population seeks healthcare services from such clinics due to accessibility and affordability, the risk associated with improper biomedical waste handling is further amplified.

Healthcare providers working in these settings may have limited knowledge and awareness regarding biomedical waste management. Previous evidence from similar low-resource settings suggests that **40–70% of healthcare workers demonstrate inadequate knowledge**, while **30–50% exhibit negative attitudes** toward safe waste management practices. Furthermore, unsafe practices such as improper segregation, reuse of contaminated materials, and unsafe disposal methods have been reported in **30–60% of cases**, increasing the risk of needle-stick injuries, cross-infection, and environmental hazards.

Despite the significant risks associated with poor biomedical waste management, there is a paucity of research focusing specifically on the knowledge, attitudes, and practices (KAP) of healthcare providers in unauthorized clinics in Lahore, Pakistan. This lack of evidence limits the ability of policymakers and public health authorities to develop targeted interventions and enforce effective regulatory measures.

For the purpose of this study, KAP will be assessed using a structured questionnaire with

predefined cut-off values. Knowledge levels will be categorized as **adequate** ($\geq 75\%$), **moderate** (50–74%), and **inadequate** ($< 50\%$); attitudes as **positive** ($\geq 70\%$) and **negative** ($< 70\%$); and practices as **good** ($\geq 75\%$), **fair** (50–74%), and **poor** ($< 50\%$). It is anticipated that a substantial proportion of healthcare providers may fall within the moderate to inadequate knowledge category (40–60%), demonstrate negative attitudes (20–40%), and exhibit poor to fair practices (30–50%).

Given the high prevalence of unsafe biomedical waste handling practices and the potential for serious health and environmental consequences, it is imperative to assess the knowledge, attitudes, and practices of healthcare providers in unauthorized clinics in Lahore. The findings of this study will help identify critical gaps and support the development of targeted educational programs, policies, and regulatory strategies aimed at improving biomedical waste management and safeguarding public health.

Research gap:

Research gap of this study was the insufficient studies were conducted on biomedical waste disposal methods. This study needs to conduct more training and education programs about biomedical waste management and disposal methods.

Objectives:

To assess the level of knowledge of healthcare providers regarding biomedical waste management, including waste segregation, color coding, storage, transportation, and disposal.

To evaluate the attitudes of healthcare providers toward safe biomedical waste management practices and adherence to recommended guidelines.

Research Questions:

Q1. What are the level of knowledge of healthcare providers regarding biomedical waste management, including waste segregation, color

coding, storage, transportation, and disposal?

Q2. What are the attitudes of healthcare providers toward safe biomedical waste management practices

And adherence to recommended guidelines?

Operational Definitions:

Knowledge: Knowledge refers to the level of understanding of healthcare providers about biomedical waste management, including sources of waste, categories, color coding, risks, and disposal methods. It will be measured using a structured questionnaire consisting of multiple-choice questions. Each correct response will be assigned one (1) mark, and incorrect responses will receive zero (0). The total score will be converted into percentages and categorized as:

- Adequate Knowledge: $\geq 75\%$
- Moderate Knowledge: 50–74%
- Inadequate Knowledge: $< 50\%$

Attitude: Attitude refers to the beliefs, perceptions, and feelings of healthcare providers regarding the importance and implementation of proper biomedical waste management practices. It will be measured using a Likert scale (e.g., strongly agree to strongly disagree). Positive responses will be scored higher. The total score will be converted into percentages and categorized as:

- Positive Attitude: $\geq 70\%$
- Negative Attitude: $< 70\%$

Practice: Practices refer to the actual actions performed by healthcare providers in handling biomedical waste, including segregation, use of personal protective equipment, storage, and disposal methods. It will be assessed using a checklist or self-reported questionnaire. Each appropriate practice will be scored one (1), and inappropriate practice will be scored zero (0). Scores will be converted into percentages and categorized as:

- Good Practice: $\geq 75\%$
- Fair Practice: 50–74%
- Poor Practice: $< 50\%$

Summary:

In the research study chapter 1 describes the background of the study, problem statement, research objectives, significance of the study about knowledge, attitude and practice regarding biomedical waste management in illegal clinics, Lahore Pakistan.

CHAPTER 3 METHODOLOGY

Introduction:

Chapter 3 describes the research design, population, and sample size calculation in relation to data collection procedures and data analysis.

Design of the study:

The design of the study was descriptive cross-sectional. A convenient sampling technique was used with a closed-ended questionnaire.

Population and sample size:

According to the previous studies we have find out 160 sample size valid for this research. The study was conducted among doctors, dentists, nurses, and nursing assistants at illegal clinics. All the relevant and irrelevant health care personnel from illegal clinics in Lahore were included in the research. These were doctors, dentists, nurses, nursing assistants and other health care personnel.

Measurement:

The measuring tool used in this study, the questionnaires, is distributed by the researchers. Firstly, the questionnaires were distributed to the population in this research, and the questionnaire has three independent variables: the first is **knowledge**, which has 12 questions; the second is **attitude**, which has 5 questions; and the third is **practice**, which has 10 questions.

Questionnaire design:

In this research, the questions have been asked in two sections through a questionnaire. In this research, information regarding gender, material status, age group, qualification, stay in the

organization, and nature of the job has been asked in a questionnaire. In this section, questions regarding variables have been asked through a questionnaire.

Data collection:

All questionnaires were completed, and data was collected from relevant and irrelevant health care personnel's in illegal clinics in Lahore. A pilot study was done to check the validity of the questionnaire.

Data analysis:

The data was analyzed using the statistical package for social science (SPSS) version 26. Descriptive statistics were applied. The results were presented in the form of frequencies; bar charts were made.

CHAPTER 4

RESULTS

Introduction:

Chapter 4 describes how the study aims to investigate the relationships between KBMW, ABMW, and PBMW. An explanation of the data gathering strategy utilized to carry out this research was covered in the proceeding chapter. SPSS 26 was used to examine the information gathered from the respondents we selected. Our study includes three variables knowledge, attitude, and practice about biomedical waste management. To obtain the results, various analyses were performed on the data.

Demographics Analysis:

Demographic analysis consists of gender, age, stay in the organization, marital status, qualifications, and job nature.

Gender:

As per the below table 4.2.1, 122 men and 38 women participated in the questionnaire-based survey. According to the percentage 160 responders in total, 76.3% were male and 23.8% were female. *Table.4.2.1*

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Section	122	76.3	76.3	76.3
Male				
Female	38	23.8	23.8	100.0
Total	160	100.0	100.0	

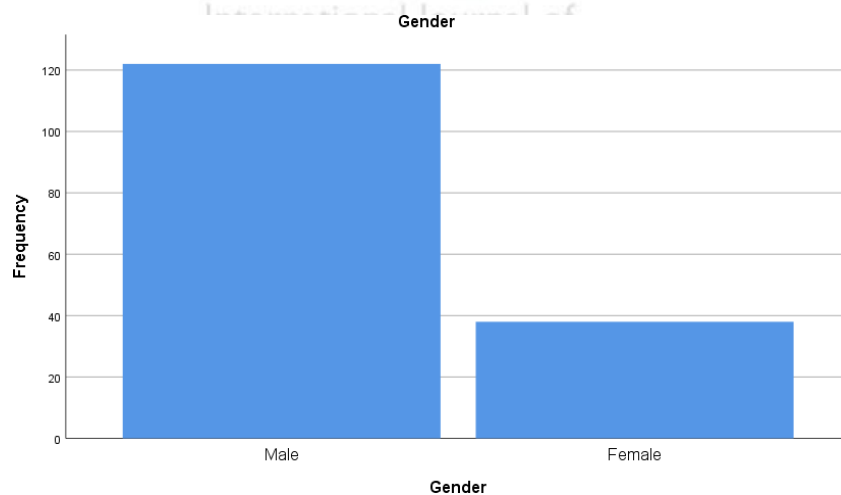


Figure 4.2.1 Gender Age:

According to the below table 4.2.2, 5 participants were in the age group of up to 20, 35 participants belongs to the age group of (20- 25), 40 participants were (26-30), 51 participants were (31-35), 22 participants were (36-40) and 7 participants were above 40. According to percentage 3.1% are form of age group of (up to 20), 21.9% are form of age group of (20-25), 25% are form of the age group of (26-30), 31.9% are form of the age group of (31-35), 13.8% are form

of the age group of (36-40) and 4.4% are form of the age 40+. Table 4.2.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	up to 20	5	3.1	3.1	3.1
	20-25	35	21.9	21.9	25.0
	26-30	40	25.0	25.0	50.0
	31-35	51	31.9	31.9	81.9
	36-40	22	13.8	13.8	95.6
	40+	7	4.4	4.4	100.0
	Total	160	100.0	100.0	

Stay in Organization:

According to table 4.2.3, 11 participants were stay in the organization up to 1 year, 88 participants were stay in the organization (1-5

years), 51 participants were stay in the organization (6-10 years), 10 participants were stay in the organization (10+ years).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	up to 1 year	11	6.9	6.9	6.9
	1-5 year	88	55.0	55.0	61.9
	6-10 year	51	31.9	31.9	93.8
	10+ year	10	6.3	6.3	100.0
	Total	160	100.0	100.0	

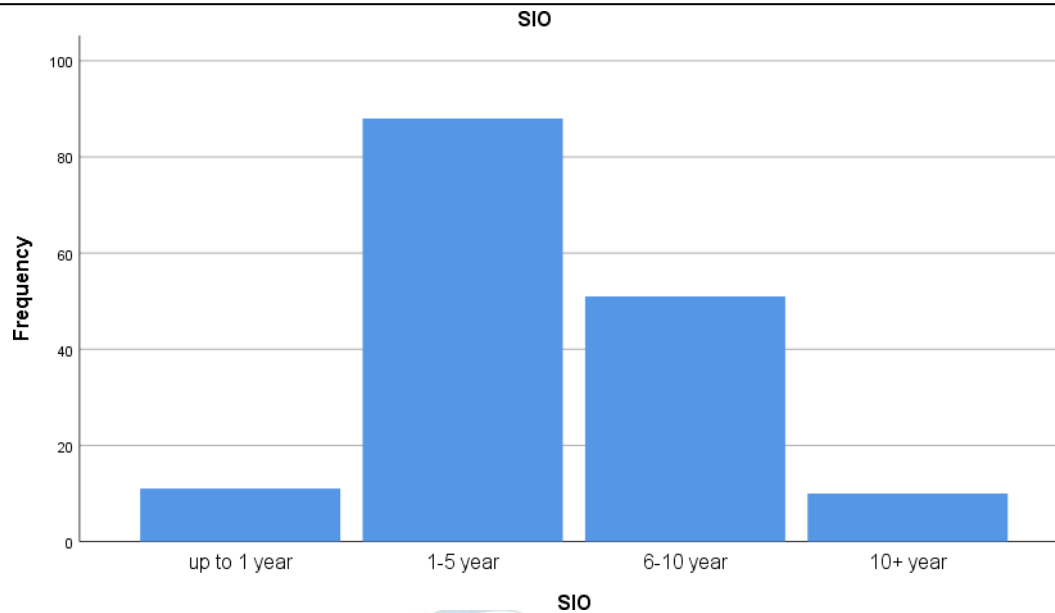


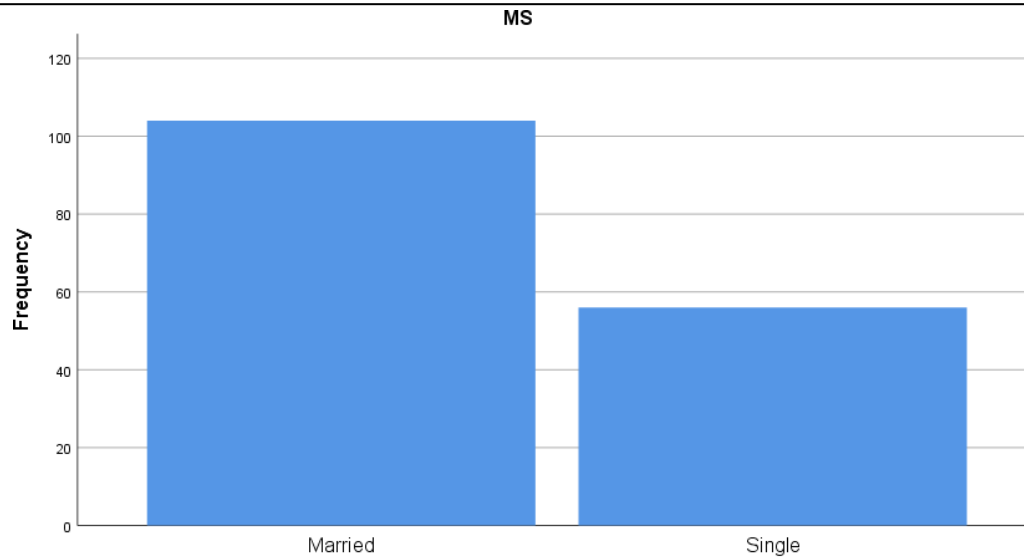
Figure 4.2.3 Stay in organization

Marital Status:

According to the table 4.2.4, 104 participants were married and 56 participants were unmarried.

According to percentage 65% participants were married and 35% participants were unmarried.
Table.4.2.4 Marital status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	104	65.0	65.0	65.0
	Single	56	35.0	35.0	100.0
	Total	160	100.0	100.0	



MS
Figure 4 Marital status

Qualification:

According to the table 4.2.5, 70 participants

were intermediate, 11 were bachelors, 8 were master and 71 were other qualification. Table 4.2.5Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Intermediate	70	43.8	43.8	43.8
	Bachelors	11	6.9	6.9	50.6
	Master	8	5.0	5.0	55.6
	Other	71	44.4	44.4	100.0
	Total	160	100.0	100.0	

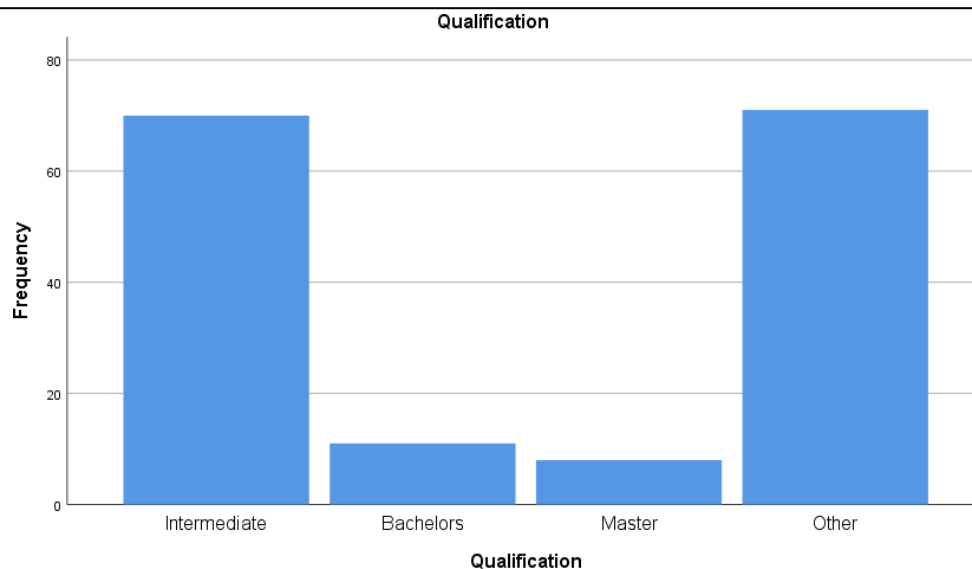


Figure 4.2.5 Qualification

Job Nature:

According to the table 4.2.6, 38 participants job nature were contract, 20 were permanent and

102 were owner. According to percentage 23.8% were on contract, 12.5% were permanent and 63.7% were owner. Table 4.2.6 Job nature

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Contract	38	23.8	23.8	23.8
	Permanent	20	12.5	12.5	36.3
	Owner	102	63.7	63.7	100.0
	Total	160	100.0	100.0	

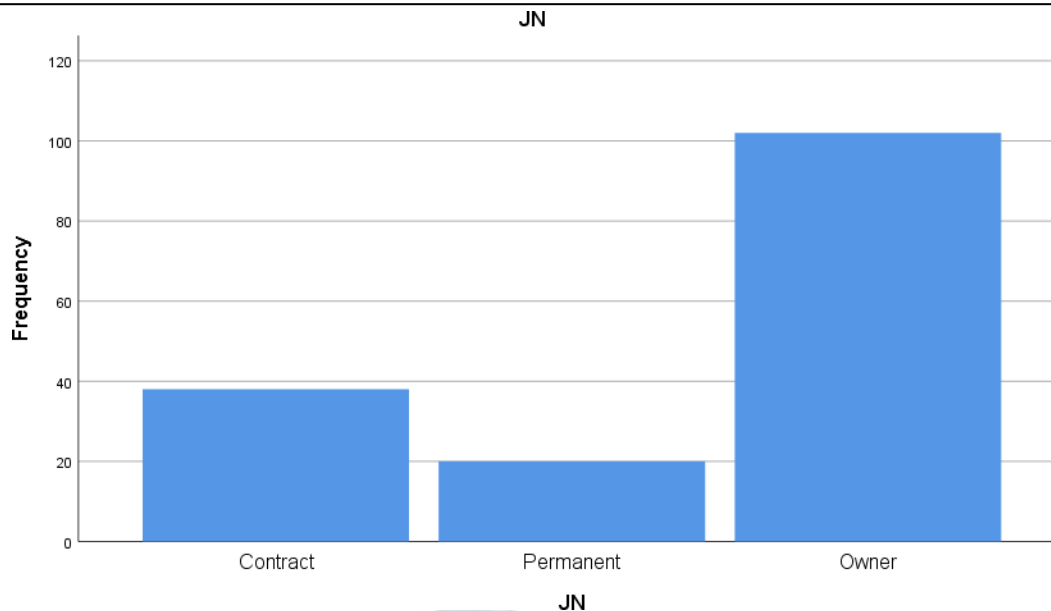


Figure 4.2.6 Job nature

Descriptive Statistics:**Knowledge about Bio medical waste management (KBMW):**

The table presents mean, standard deviation, skewness and kurtosis for the variable of the study. Mean and standard deviation for KBMW1, is 2.6812 and 1.12363 respectively, KBMW2, is 2.9250 and .94868 respectively, KBMW3, is 2.9375 and 1.07976 respectively, KBMW4, is 2.8000 and .96348, KBMW5, is

2.7313 and .98875 respectively, KBMW6, is 2.7000 and 1.01436 respectively, KBMW7, is 2.6500 and .94636 respectively, KBMW8, is 2.6875 and 1.04121 respectively, KBMW9, is 2.7125 and 1.03028 respectively, KBMW10, is 2.9250 and 1.12462 respectively, KBMW11, is 2.8938 and 1.11365 respectively, KBMW12, is 2.8562 and 1.19141 respectively and KBMW13, is 2.8438 and 1.01898 respectively. The values of skewness and kurtosis were between -2 to +2. Thus the data was normally distributed.

Table 4.3.1 Knowledge about Bio medical waste management (KBMW)

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
KBMW1	160	1.00	5.00	2.6812	1.12363	.198	.192	-1.020	.381
KBMW2	160	1.00	5.00	2.9250	.94868	-.073	.192	-.314	.381
KBMW3	160	1.00	5.00	2.9375	1.07976	-.057	.192	-.814	.381
KBMW4	160	1.00	5.00	2.8000	.96348	.113	.192	-.337	.381
KBMW5	160	1.00	5.00	2.7313	.98875	.247	.192	-.631	.381
KBMW6	160	1.00	5.00	2.7000	1.01436	-.027	.192	-.620	.381
KBMW7	160	1.00	5.00	2.6500	.94636	.258	.192	-.557	.381
KBMW8	160	1.00	5.00	2.6875	1.04121	.082	.192	-.681	.381
KBMW9	160	1.00	5.00	2.7125	1.03028	.113	.192	-.974	.381

KBMW10	160	1.00	5.00	2.9250	1.12462	.257	.192	-.818	.381
KBMW11	160	1.00	5.00	2.8938	1.11365	.157	.192	-.781	.381
KBMW12	160	1.00	5.00	2.8562	1.19141	.259	.192	-.761	.381
KBMW13	160	1.00	5.00	2.8438	1.01898	.066	.192	-.758	.381
Valid N (listwise)	160								

Attitude about Bio medical waste management (ABMW):

The table presents mean, standard deviation, skewness and kurtosis for the variable of the study. Mean and standard deviation for ABMW1, is 2.8188 and 1.15944 respectively,

ABMW2, is 2.8625 and 1.01862 respectively, ABMW3, is 2.8625 and 1.04903 respectively, ABMW4, is 2.7438 and .97933, ABMW5, is 2.8750 and 1.00783 respectively. The values of skewness and kurtosis were between -2 to +2. Thus the data was normally distributed.

Table4.3.2 Attitude about Bio medical waste management (ABMW)

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ABMW1	160	1.00	5.00	2.8188	1.15944	.140	.192	-.985	.381
ABMW2	160	1.00	5.00	2.8625	1.01862	.172	.192	-.383	.381
ABMW3	160	1.00	5.00	2.8625	1.04903	.081	.192	-.608	.381
ABMW4	160	1.00	5.00	2.7438	.97933	.169	.192	-.361	.381
ABMW5	160	1.00	5.00	2.8750	1.00783	-.082	.192	-.714	.381
Valid N (listwise)	160								

Practice about Bio medical waste management (PBMW):

The table presents mean, standard deviation, skewness and kurtosis for the variable of the study. Mean and standard deviation for PBMW1, is 2.8250 and 1.12462 respectively, PBMW2, is 2.7188 and 1.05908 respectively, PBMW3, is 2.6437 and 1.11788 respectively, PBMW4, is 2.7812 and .98205, PBMW5, is 2.7562 and

.92991 respectively, PBMW6, is 2.8500 and 1.06517 respectively, PBMW7, is 2.6000 and 1.05925 respectively, PBMW8, is 2.6188 and 1.06913 respectively, PBMW9, is 2.7125 and .96731 respectively and PBMW10, is 2.4688 and 1.13227 respectively. The values of skewness and kurtosis were between -2 to +2. Thus the data was normally distributed.

Table 4.3.3 Practice about Bio medical waste management (PBMW)

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PBMW1	160	1.00	5.00	2.8250	1.12462	.217	.192	-.613	.381
PBMW2	160	1.00	5.00	2.7188	1.05908	.263	.192	-.604	.381
PBMW3	160	1.00	5.00	2.6437	1.11788	.249	.192	-.854	.381
PBMW4	160	1.00	5.00	2.7812	.98205	.049	.192	-.677	.381
PBMW5	160	1.00	5.00	2.7562	.92991	.031	.192	-.287	.381
PBMW6	160	1.00	5.00	2.8500	1.06517	.178	.192	-.806	.381
PBMW7	160	1.00	5.00	2.6000	1.05925	.152	.192	-.557	.381
PBMW8	160	1.00	5.00	2.6188	1.06913	.249	.192	-.558	.381
PBMW9	160	1.00	5.00	2.7125	.96731	.268	.192	-.290	.381
PBMW10	160	1.00	5.00	2.4688	1.13227	.315	.192	-.690	.381
Valid N (listwise)	160								

Descriptive statistics each variable wise:

The table presents the mean and standard deviation for KBMW is 2.7957 and .56323 respectively.

Whereas, mean and standard deviation for ABMW is 2.8325 and .59890 respectively. Further, mean and standard deviation for PBMW is 2.6975 and .58782 respectively. Moreover, Additionally, the table presents skewness and kurtosis values. The value of skewness and kurtosis for KBMW is .356 and -.253 respectively. The value of skewness and kurtosis for ABMW is .268 and .803 respectively. The value of skewness

and kurtosis for PBMW is .163 and .192 respectively. All the values for skewness and kurtosis are between the range of +2 and -.2. Thus, the data is normally distributed.

Further, the table presents that the Cronbach's alpha of KBMW was .755, Cronbach's alpha of ABMW was .795 and Cronbach's alpha of PBMW was .489 respectively. It is concluded that by applying reliability analysis. The Cronbach's alpha value of all variables are reliable since these values are greater than 0.7.

Table 4.3.4 Descriptive statistics each variable wise

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
KBMW	160	1.54	4.46	2.7957	.56323	.356	.192	-.253	.381
ABMW	160	1.40	4.60	2.8325	.59890	.268	.192	.803	.381
PBMW	160	1.50	4.20	2.6975	.58782	.163	.192	-.330	.381
Valid N (listwise)	160								

Reliability analysis

Knowledge about bio medical waste management (KBMW):

Cronbach's alpha of KBMW was .755, indicates the Cronbach's alpha is > 0.7 . Hence, data reliable exist.

Table 4.4.1 (KBMW) Reliability Analysis

Reliability Statistics

Cronbach's	
Alpha	N of Items
.755	10

Attitude about biomedical waste management (ABMW):

Cronbach's alpha of ABMW was .795, indicates

the Cronbach's alpha is > 0.7 . Hence, data reliable exist.

Table 4.4.2 (ABMW) Reliability Analysis

Reliability Statistics

Cronbach's	
Alpha	N of Items
.795	13

Practice about biomedical waste management (PBMW):

Cronbach's alpha of PBMW was .489, indicates

the Cronbach's alpha is > 0.7 . Hence, data reliable exist.

Table 4.4.3 (PBMW) Reliability Analysis

Reliability Statistics

Cronbach's

Alpha

N of Items

.489

5

Validity Analysis:

Knowledge about biomedical waste management (KBMW):

The test of Bartlett's sphericity shows significant

results demonstrative that the information can be used for factor analysis at $\chi^2(n=160) = 415.569$ ($p < 0.001$), the value of KBMW .775.

Table 4.5.1 (KBMW) Validity Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy. .775

Bartlett's Test of Sphericity Approx. Chi-Square 415.569

Df 78

Sig. .000

Attitude about biomedical waste management (ABMW):

The test of Bartlett's sphericity shows significant

results demonstrative that the information can be used for factor analysis at $\chi^2(n=160) = 52.798$ ($p < 0.001$), the value of ABMW .567.

KMO and Bartlett's Test

Table 4.5.2 (ABMW) Validity Analysis

Kaiser-Meyer-Olkin Measure of Sampling Adequacy. .567

Adequacy.

Bartlett's Sphericity Test of Approx. Chi-Square 52.796

	Df	10
	Sig.	.000

Practice about biomedical waste management (PBMW):

The test of Bartlett's sphericity shows significant

results demonstrative that the information can be used for factor analysis at $\chi^2(n=160) = 280.217$ ($p < 0.001$), the value of PBMW .774.

KMO and Bartlett's Test

Table 4.5.3 (PBMW) Validity Analysis

Kaiser-Meyer-Olkin	Measure of Sampling Adequacy.	.774
Bartlett's Sphericity	Test of Approx. Chi-Square	280.217
	Df	45
	Sig.	.000

CHAPTER 5 DISCUSSION AND CONCLUSION

Introduction:

The present study of Chapter 5 opens with a review and discussion of the findings. The present study not only summarizes but also draws conclusions and findings. Research questions and objectives are discussed in detail and reviewed in accordance with the research study findings. The chapters also provided justification for the significant and insignificant research study along with presenting practical implications and the theoretical.

Recapitulation of the findings:

The purpose of the study was to show that medical care is very important for our lives and health, but the waste that healthcare facilities generate imposes issues on living nature and the human world, and improper management of waste has a direct impact on our health. This study identifies awareness, knowledge, and attitudes about biomedical waste management. Additionally, the study has considered two variables: independent (knowledge, attitude, and practice) and dependent (biomedical waste management). Accordingly, three research questions were developed, which are as follows:

Do healthcare professionals have enough knowledge of biomedical waste generation, hazards, and legislation?

What is the level of awareness of biomedical waste management practices among healthcare professionals?

What is the knowledge among healthcare providers regarding needle stick injuries in clinics?

Data were collected from health care personnel's in illegal clinics in Lahore, Pakistan. The totals of 250 questionnaires were distributed in all over different illegal clinics in Lahore, Pakistan. A total of 160 questionnaires were returned by respondents. When we conducted data screening, valid questionnaires yielded a response rate of 64%.

SPSS was used for the frequency analysis, descriptive statistics, and data normality.

Discussion:

This part of the study deals with a discussion of the findings of the present study. It discusses the points of direct relationship between knowledge, attitude, and practice in biomedical waste management.

To examine the relationship between knowledge, attitude and practice about biomedical waste management:

Biomedical waste (BMW) management is a very important issue of concern to all health care personnel. This study aims to evaluate knowledge, practice, and attitude regarding biomedical waste. If health care providers have enough knowledge about biomedical waste management, the relationship between knowledge and practice shows a positive impact. If health care providers have enough knowledge about BMW and they get wrong practices in clinical areas, that attitude shows a negative impact.

Contribution of the study:

Nowadays, biomedical waste management has become a hazardous issue. In healthcare, various types of waste can be produced, including sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices, and radioactive materials (Assemu, D.M. et al., 2020). There are various colors that indicate different types of biomedical waste. These color also indicate the level of caution that needs to be taken when handling such materials. These are the following colors:

Yellow: A yellow-colored waste being indicates many types of waste. There can be excreta, tissues, organs, body fluids, and dirty bed sheets.

Red: Red color is used for contaminated waste products. For example, iv tube, catheters, tubing and syringes can all be collected in red bins.

White: White is used for sharps, needles, scalpels, or blades.

Blue: Blue is used to discard glass materials, beakers, medication vials, and other broken glass

This study identifies the awareness of knowledge, attitude, and practice about biomedical waste management.

Theoretical contribution:

This study is used to understand people's awareness of knowledge, attitudes, and practices about health promotion and prevention. This study is related because we can increase awareness and provide them with knowledge about biomedical waste management and rules through education and training sessions to modify their practices towards proper handling of waste and promote their well-being.

Practical contribution:

In the practical contribution of biomedical waste management, develop and design the analysis and collect the data of biomedical waste from illegal clinics in Lahore, Pakistan, and contribute data and analysis after the research study. It also intends to raise awareness among the personnel concerned about the illegal clinics in Lahore, Pakistan. Biomedical waste management plays a vital role in preventing any outbreak of infectious diseases and protecting society.

Limitations and future direction:

Although the study has proficiently addressed the objectives and answered the research questions, there are still some limitations in the research area. First of all, the study was descriptive, which is designed to describe the distribution of one or more variables without regard to any casual or other hypothesis. Therefore, future studies are encouraged based on what you are aware of about biomedical generation and also about color-coding segregation in biomedical waste management. The present study is of a quantitative nature; future studies are designed and encouraged to advance the conceptual contribution and awareness about biomedical waste management. If healthcare providers have enough knowledge about biomedical waste management and they get wrong practices in clinical areas, that study has considered the negative impact of health care personnel. The future studies will help and encourage positive impact and awareness.

Conclusion:

The study was conducted in order to evaluate awareness of knowledge, attitude, and practice about biomedical waste management in illegal clinics, which can prevent many common infections, injuries, and hazards. In the study, a very large number of participants were not aware of the rules of biomedical waste management that were made and amended, but a maximum percentage of participants thought that it was important to know about biomedical waste management, and as many of them knew about the basic rules regarding biomedical waste handling and disposal. This study should conduct awareness programs and set protocols regarding biomedical waste management to create a safe environment in illegal clinics.

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Questioner

SECTION A- BACKGROUND INFORMATION

This section of the questionnaire refers to background or biographical information. Although we are aware of the sensitivity of the questions in the section, the information will allow us to compare groups of respondents. Once again, we assure you that your response will remain anonymous. Your cooperation is appreciated.

Gender	☐ Male ☐ Female	Marital Status	☐ Married ☐ Single
Age Group	☐ Up to 20 ☐ 20-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ 40+	Qualification	☐ Intermediate ☐ Bachelors ☐ Master ☐ Other
Stay in organization	☐ Up to 1Year ☐ 1-5Year ☐ 6-10Year ☐ 10+Year	Job nature	☐ Contract ☐ Permanent ☐ Owner

SECTION B

To what extent do you agree with each of the following statements. Please indicate your answer using the following 5 points scale where:

1-Strongly disagree 2-Disagree

3-Neutral 4-Agree

5-Strongly agree

	The response to the item relating (BMW)management.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	You are aware of biomedical waste generation.	1	2	3	4	5
2	You are aware about BMW legislation.	1	2	3	4	5
3	BMW is generated from healthcare facilities.	1	2	3	4	5
4	According to the BMW management rules, waste should not be stored beyond 48 hrs.	1	2	3	4	5
5	A separate permit need to transport BMW.	1	2	3	4	5
6	You are aware about color coding segregation of BMW.	1	2	3	4	5
7	Approximately 10-20% of infectious among total waste generated from health care facility.	1	2	3	4	5
8	Approximately 30-40% of infectious among total waste generated from health care facility.	1	2	3	4	5
9	Approximately 50-60% of infectious among total waste generated from health care facility.	1	2	3	4	5
10	Needle stick injury is a concern.	1	2	3	4	5
11	Used needles should be recapped.	1	2	3	4	5

12	Immediately used needles should be disposed of.	1	2	3	4	5
13	You are aware about the consequences of needle stick injury.	1	2	3	4	5
The response to the item relating to the respondents Attitude regarding BMW.						
1	Waste management is teamwork not single class of people is responsible for safety management.	1	2	3	4	5
2	The hospital should organize separator training to upgrade existing knowledge about	1	2	3	4	5
3	To attend voluntary programs that enhance your knowledge about BMW management.	1	2	3	4	5
4	Labeling the containers before filling it with waste is any clinical significance.	1	2	3	4	5
5	Health care workers should wear personal protective equipment (PPE) while handling BMW.	1	2	3	4	5
The response to the item relating to the Practice of BMW management.						
1	Work instructions for segregation and handling of biomedical waste has been displayed prominently.	1	2	3	4	5
2	Placement of 4 color coded bins as per BMW management rule 2016.	1	2	3	4	5
3	Bins placed on stand.	1	2	3	4	5

4	BMW bins are covered.	1	2	3	4	5
5	Segregation of BMW is done as per BMW rule 2016.	1	2	3	4	5
6	The staff uses needle cutters for cutting the syringe needles.	1	2	3	4	5
7	Sharp waste is stored in puncture proof containers.	1	2	3	4	5
8	The biohazard symbol; imprinted over waste bags.	1	2	3	4	5
9	Yellow bag contain only anatomical waste.	1	2	3	4	5
10	Accident report submitted to state pollution control board (SPCB) including "NIL" report.	1	2	3	4	5